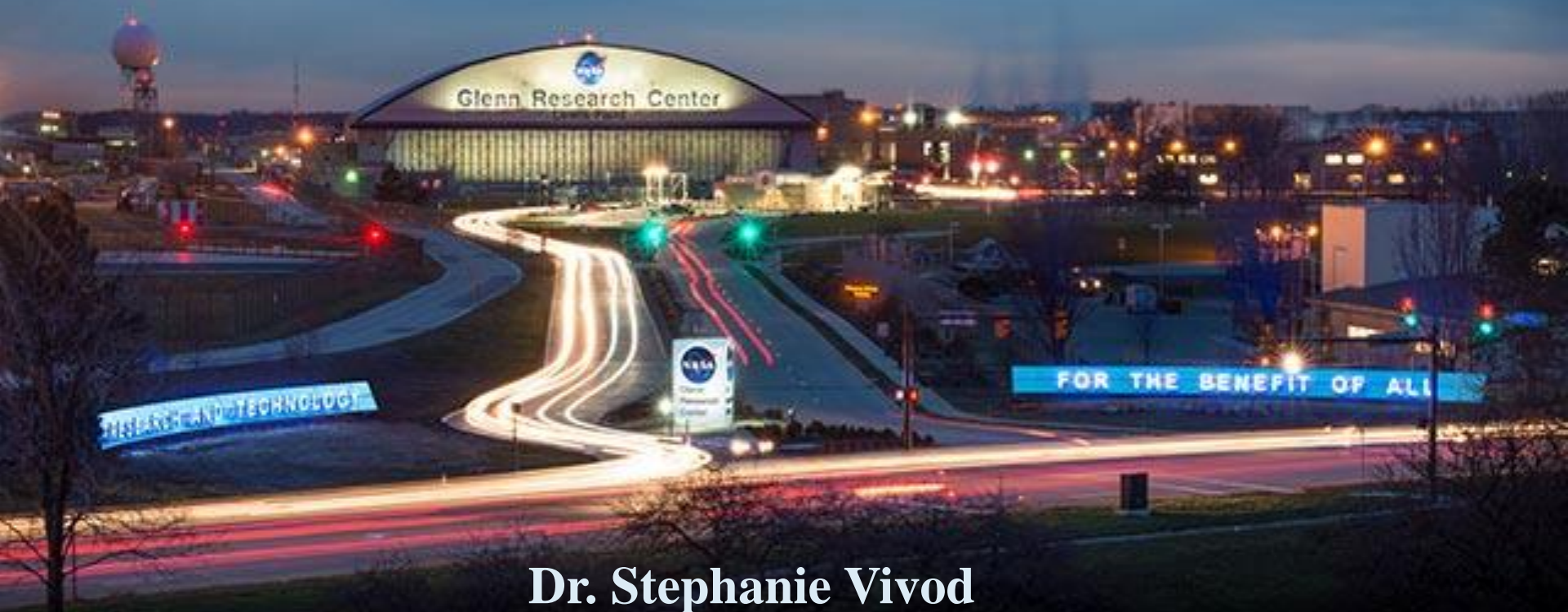


Careers at NASA: A Universe of Options

Texas A&M POLY/PMSE Chemistry Career Series



Dr. Stephanie Vivod

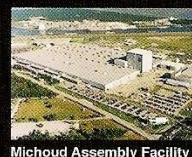
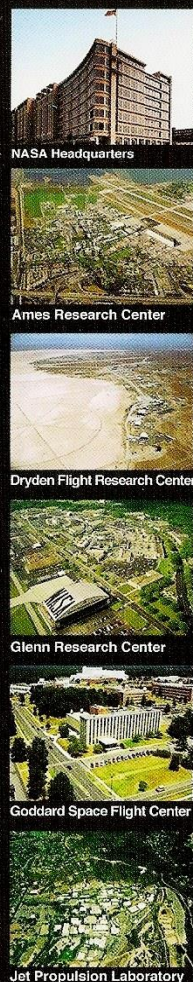
Research Chemical Engineer

Materials Chemistry and Physics Branch

NASA Glenn Research Center, Cleveland OH



NASA Glenn Research Center

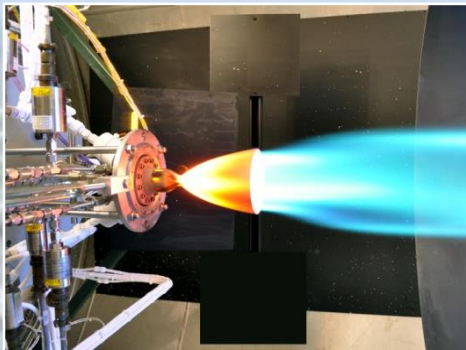


NASA centers and facilities

GRC Core Competencies



Air-Breathing Propulsion



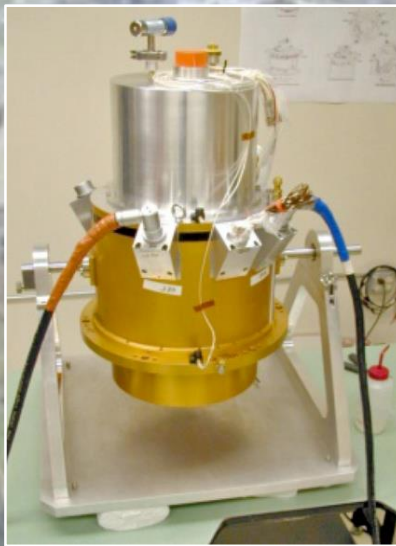
**In-Space Propulsion and
Cryogenic Fluids Management**



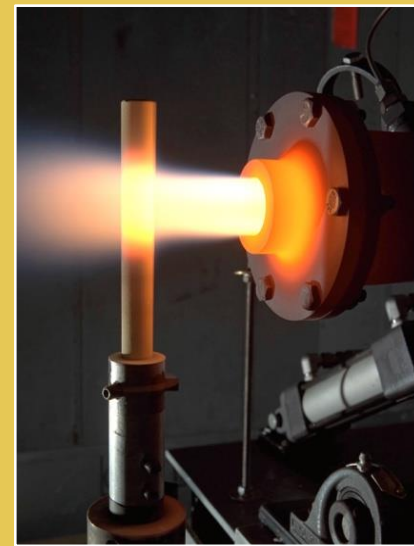
**Physical Sciences and
Biomedical Technologies in Space**



**Communications Technology
and Development**



**Power, Energy Storage and
Conversion**



**Materials and Structures
for Extreme Environments**



Artemis

WE'RE GOING BACK!



Artemis Program: Return to moon-2024

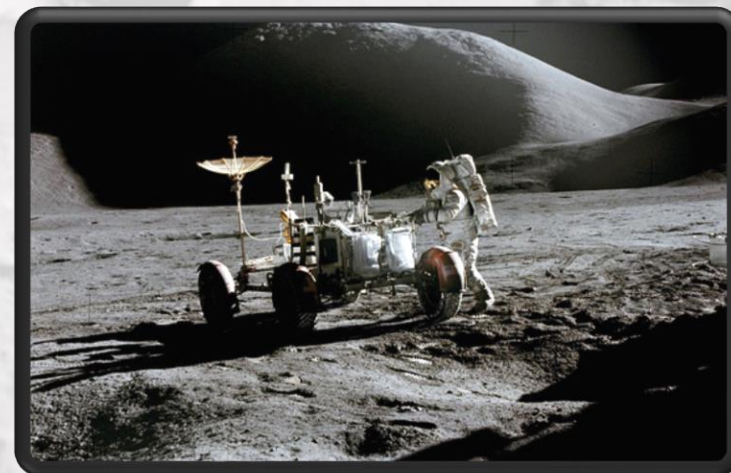
<https://www.nasa.gov/specials/artemis/>



Apollo Program ran from 1961 to 1972

Moon Landing Missions:

- **Apollo 11 (1969)** Neil Armstrong (Commander), Buzz Aldrin, Michael Collins
- **Apollo 12 (1969)** Charles "Pete" Conrad (Commander), Alan Bean, Richard Gordon
- ***Apollo 13 (1970)** James Lovell (Commander), Jack Swigert, Fred Haise
- **Apollo 14 (1971)** Alan Shepard (Commander), Edgar Mitchell, Stuart Rosa
- **Apollo 15 (1971)** David Scott (Commander), James Irwin, Alfred Worden
- **Apollo 16 (1972)** John Young (Commander), Charles Duke, Thomas Mattingly
- **Apollo 17 (1972)** Eugene Cernan (Commander), Harrison Schmitt, Ronald Evans



Apollo 15-Astronaut James B. Irwin, lunar module pilot, works on the Lunar Roving Vehicle

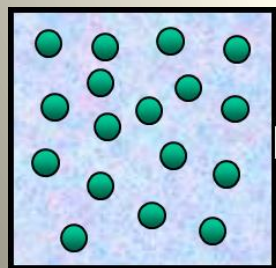
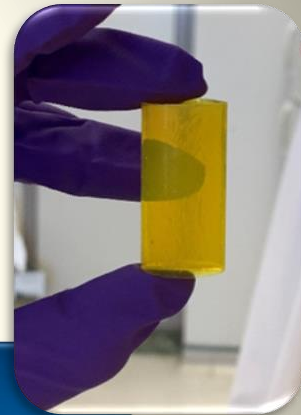
NASA is now preparing for an ambitious new era of sustainable human spaceflight and discovery



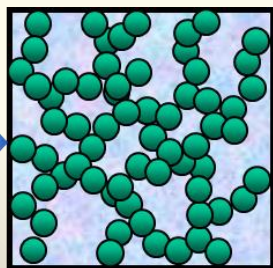
The Wonderful World of Polymer Aerogels!

An open-celled, light weight, porous material derived from a gel in which the liquid is replaced by gas while maintaining the self-assembled three-dimensional structure

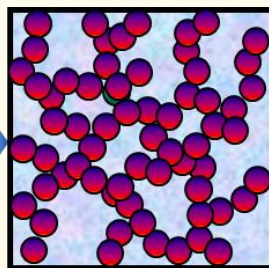
- High porosity ($> 90\%$)
- Nano-scale pore sizes (10-40 nm)
- Large surface areas (400 – 850 m^2/g)
- Low density (0.05-0.2 g/cm^3)
- Low thermal conductivity ($\sim 20 \text{mW}/\text{m}\cdot\text{K}$)
- Low dielectric (1.1)
- Low refractive index (1.02-1.09)



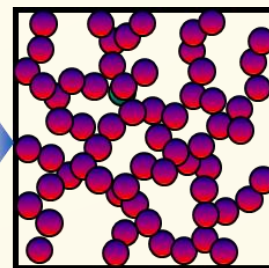
Monomers



Polyamic
Acid Gel

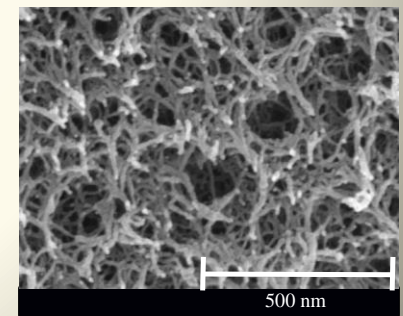


Polyimide
Gel



Polyimide
Aerogel

Polyimide Aerogels made using sol-gel synthesis and supercritical fluid extraction

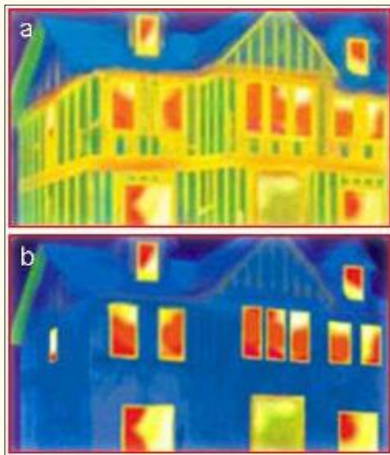


*Scanning Electron Micrograph of
polymer aerogel matrix*

Commercial applications



Outdoor gear/apparel



Home insulation



Pipeline wrap



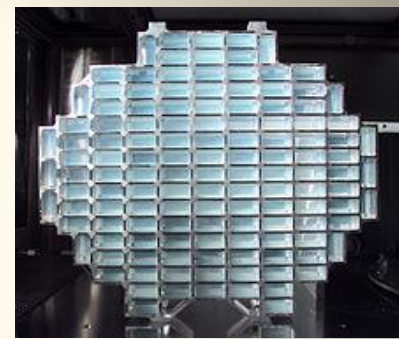
Architectural day lighting

Aerogel insulation for building applications: A state-of-the-art review

Space exploration applications



Insulation for EVA suits

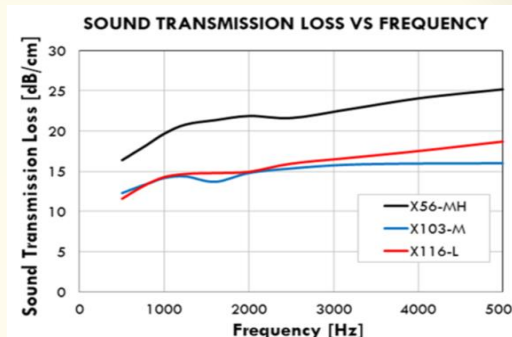
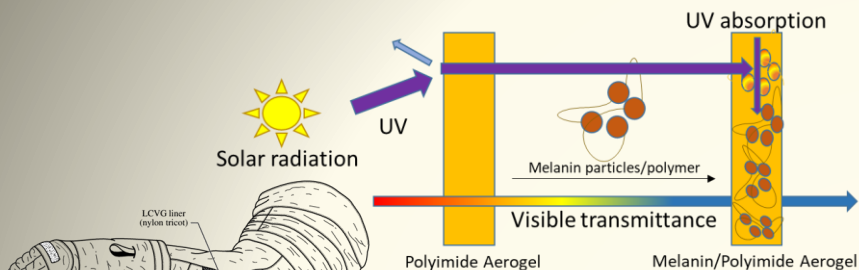


Particle capture

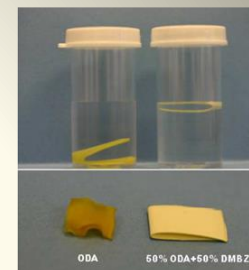


Ultra-lightweight, multifunctional structures for rovers, habitats, and thermal protection systems (TPS)

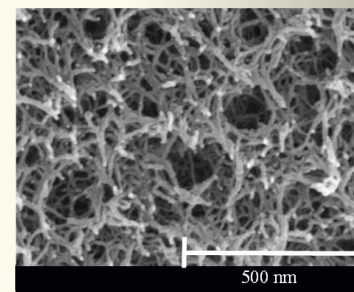
Polyimide Aerogel Development



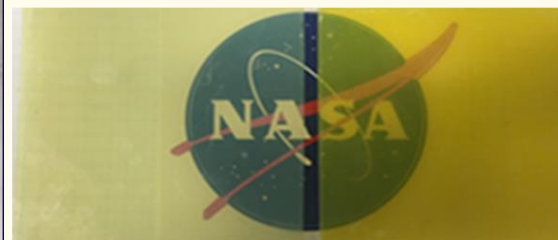
Acoustic impedance



Tailored
Hydrophobicity



Tunable pore structure



Tunable Transparency

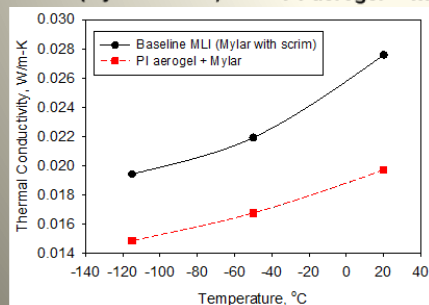
Radiation mitigation



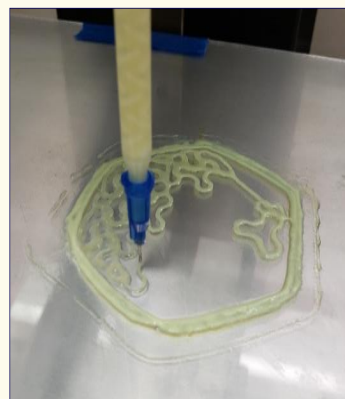
Baseline MLI (Mylar + scrim)



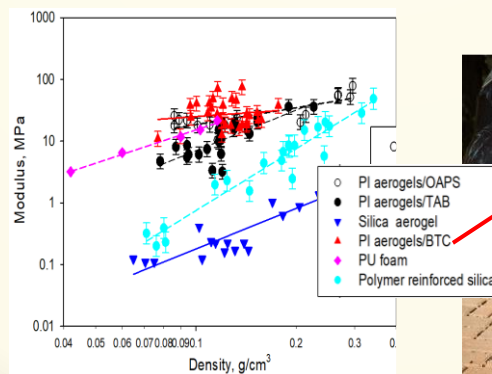
PI aerogel + Mylar



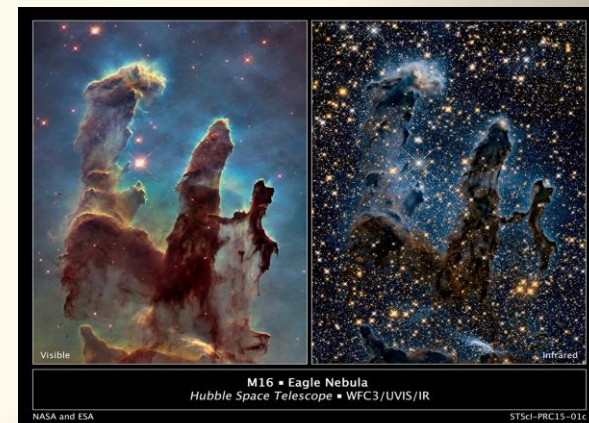
Enhanced thermal impedance



3D printing



Improved mechanical properties

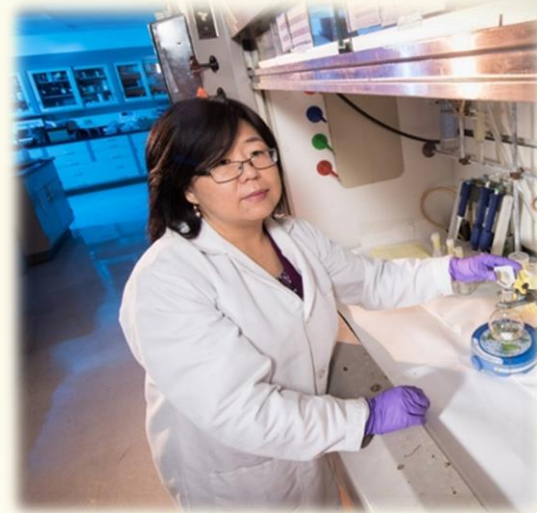


IR filtration

GRC Aerogel Laboratories



Dr. Stephanie Vivod
Polymer aerogel lead



Dr. Haiquan Guo
Senior Research Scientist



Dr. Sadeq Malakooti
NASA Post-Doc

- NASA employees
- Contract employees
- Student interns
- Summer faculty
- Post Doctoral Fellows



Ariel Tokarz
Pathways Intern

Typical...ish day as an:

AST (Aerospace Technology) Research Chemical Engineer, Aerospace Polymeric Materials for Extreme Environments

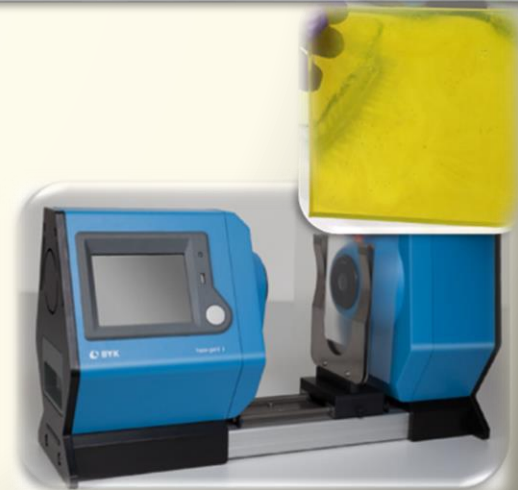


- ❖ Synthesis
- ❖ Literature search, materials research



- ❖ Technology transfer
- ❖ Operate the Supercritical Fluid Extractor

- ❖ Materials Analysis & Characterization





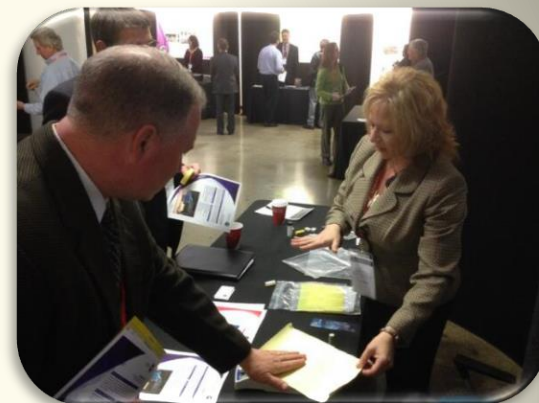
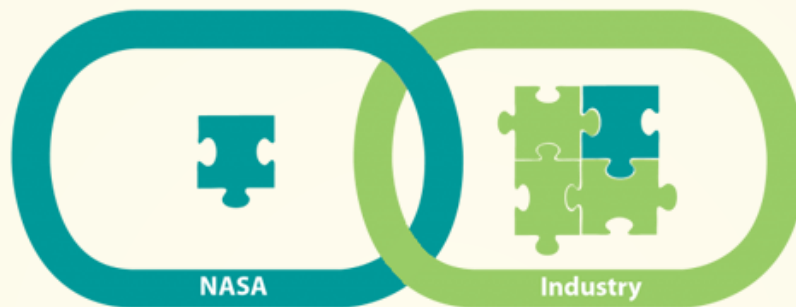
Outreach Events



Technology Transfer Office

Leverage the outstanding capabilities and accomplishments of NASA's Glenn Research Center for the benefit of both NASA and U.S. taxpayers

- Licensing- NASA's patent portfolio
- Innovative Research Grants
- Cooperative Agreement
- Interagency Transfer



Automotive Industry Workshop
at NASA Glenn

NASA Glenn Research Center

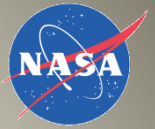
TECHNOLOGY SHOWCASE



Auto Technology Workshop hosted by
MAGNET and the Center for Automotive
Research at The Ohio State University



National Aeronautics and Space Administration



America's civil space program and the global leader in space exploration

NASA VISION:

To reach for new heights and reveal the unknown so that what we do and learn will benefit all humankind

- ✓ Diverse workforce of over 25,000 civil servants
 - works with many more U.S. contractors, academia, and international and commercial partners to explore, discover, and expand knowledge for the benefit of humanity
- ✓ Annual budget of \$23.2 billion in Fiscal Year 2021 (less than 0.5% of the overall U.S. federal budget)
- ✓ Supports more than 500,000 jobs across the United States
- ✓ Generating more than \$64.3 billion in total economic output (return on investment)

TRANSITIONING IDEAS INTO REALITY
SPIN OFF TECHNOLOGIES



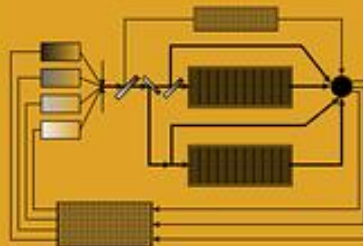


RESEARCH

GLENN RESEARCH
**OPERATING SPACE
EXPERIMENTS FROM EARTH**
GLENN'S EMBEDDED WEB TECHNOLOGY (EWT)
SOFTWARE ENABLED SCIENTISTS TO OPERATE
EXPERIMENTS ON THE INTERNATIONAL
SPACE STATION IN REAL TIME FROM
ANYWHERE ON EARTH.

BENEFIT

RESEARCH BENEFIT
**TEXTING OR GOOGLING
YOUR OVEN**
TMIO'S CONNECT IO INTELLIGENT OVEN USED
TECHNOLOGY BASED ON EWT TO ENABLE
USERS TO CONTROL ROASTS AND CASSEROLES
REMOTELY VIA ANY DEVICE WITH WEB ACCESS.

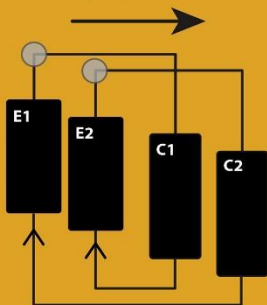
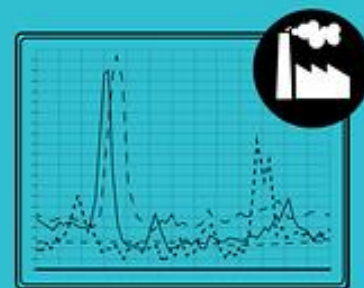


RESEARCH

GLENN RESEARCH
**STUDIES OF
AIRCRAFT EMISSIONS**
GLENN TECHNOLOGY HELPED USED AEROVYNERE-
SEARCH INC.'S (AIRS) TO DEVELOP A TUNABLE
SPECTROMETER (TILDAS) TO MEASURE, IN PARTS PER
BILLION, EMISSION GASES FROM AIRCRAFT, CITY
BUSES IN NEW YORK, AND TRAFFIC IN MEXICO CITY.

BENEFIT

RESEARCH BENEFIT
**DEVICE FOR STUDYING
AIR QUALITY AND
CLIMATE CHANGE**
AIR'S QUANTUM CASCADE (QC) TILDAS HAS
BEEN USED TO STUDY AND MONITOR CLIMATE
CHANGE, GAS TURBINE EMISSIONS, HEALTH
AND SAFETY, AND AIR QUALITY.

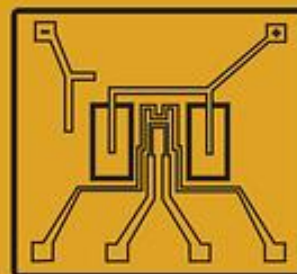


RESEARCH

GLENN RESEARCH
EFFICIENT COOLING IN SPACE
GLENN DEVELOPED A NEW, HIGH PERFORMANCE, PASSIVE,
AND LIGHTWEIGHT PASSIVE HEAT TRANSPORT SYSTEM FOR
SPACE COOLING APPLICATIONS.

BENEFIT

RESEARCH BENEFIT
**IMPROVED RESIDENTIAL
HEATING AND COOLING**
LENNOX INC. USED THE GLENN TECHNOLOGY TO BUILD
AND TEST A LARGE SCALE PASSIVE HEAT TRANSPORT
SYSTEM FOR USE IN A MORE EFFICIENT AND EFFECTIVE
HOME HEATING AND COOLING SYSTEM.

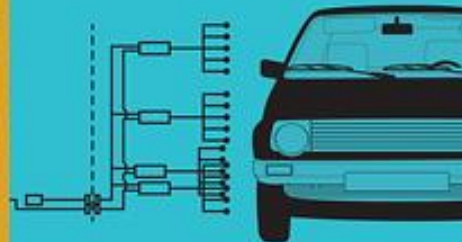


RESEARCH

GLENN RESEARCH
**AUTOMATED HYDROGEN
LEAK DETECTION**
GLENN ENGINEERING DEVELOPED CHEMICAL SENSORS TO
DETECT POTENTIAL HYDROGEN LEAKS DURING
SPACE SHUTTLE LAUNCH OPERATIONS.

BENEFIT

RESEARCH BENEFIT
**SAFER HYDROGEN
POWERED VEHICLES**
MAREL ENGINEERING, INC. COMMERCIALIZED GLENN'S
AUTOMATED HYDROGEN SENSING TECHNOLOGY TO
PROVIDE A LEAK SENSING SYSTEM FOR FORD MOTOR
COMPANY'S PROTOTYPE HYDROGEN-POWERED
TRUCK VEHICLES.





Polymers Advance Heat Management Materials for Vehicles

Marshall Space Flight Center

*StarFire Systems Inc.
Schenectady, NY*

NASA Technology

- ◆ On Space Shuttle missions following the Columbia accident, a powerful sealant was to be made available on all flights to repair external spacecraft damage.
- ◆ Especially important was that the sealant be resistant to extreme heat.



Technology Transfer

- ◆ With NASA funding, StarFire Systems Inc. demonstrated and tested SMP-10, a polymer that would convert to ceramic when exposed to temperatures above 1500°F.
- ◆ The ceramic held up to burning temperatures present during re-entry into the earth's atmosphere.

Benefits

- ◆ StarFire now has an offshoot line of extreme-heat-resistant polymers called StarPCS, used in the military, aviation, and automotive markets.
- ◆ The product is being tested for use in Formula 1 race cars, both as a heat shield to protect drivers from engine components and as part of a new exhaust system meant to increase horsepower.



Sensors Enable Plants to Text Message Farmers

Marshall Space Flight Center

*AgriHouse
Berthoud, CO*

NASA Technology

- ◆ Astronauts living in space for extended periods of time, like those on deep-space missions, will need to grow their own food.
- ◆ As resources in space are severely limited and costly, systems that maximize efficiency will make long-term space flight possible.



Technology Transfer

- ◆ AgriHouse partnered with BioServe Space Technologies, recipient of Small Business Innovation Research (SBIR) funding, to develop sensors that use electrical pulses to determine when a plant loses its rigidity to the point where it needs water.
- ◆ In a laboratory test, the new system decreased water usage by between 25 and 45 percent.

Benefits

- ◆ The technology will allow farmers in the water-scarce West to conserve their resources.
- ◆ While current users are researchers, MBA students are working on business models to expand the product's reach in the market.
- ◆ AgriHouse sees a future where farmers can receive text messages on their plants' health.

NASA Spin-off Technology



CMOS IMAGE SENSOR

When NASA needed miniature cameras for interplanetary missions, they created the CMOS active pixel sensor.



MEMORY FOAM

Originally designed by NASA-funded researchers to keep test pilots cushioned during flights.



SCRATCH-RESISTANT SUNGLASSES

NASA's Ames Research Center conducted research on ways to protect astronaut helmet visors from scratches, as well as increase their ability to filter out UV-rays and enhance colors.



GLOBAL POSITIONING SYSTEM (GPS)

NASA's Jet Propulsion Laboratory (JPL) developed a software in the 1990s to correct errors in the data from their global network of receivers.

And don't forget about these:

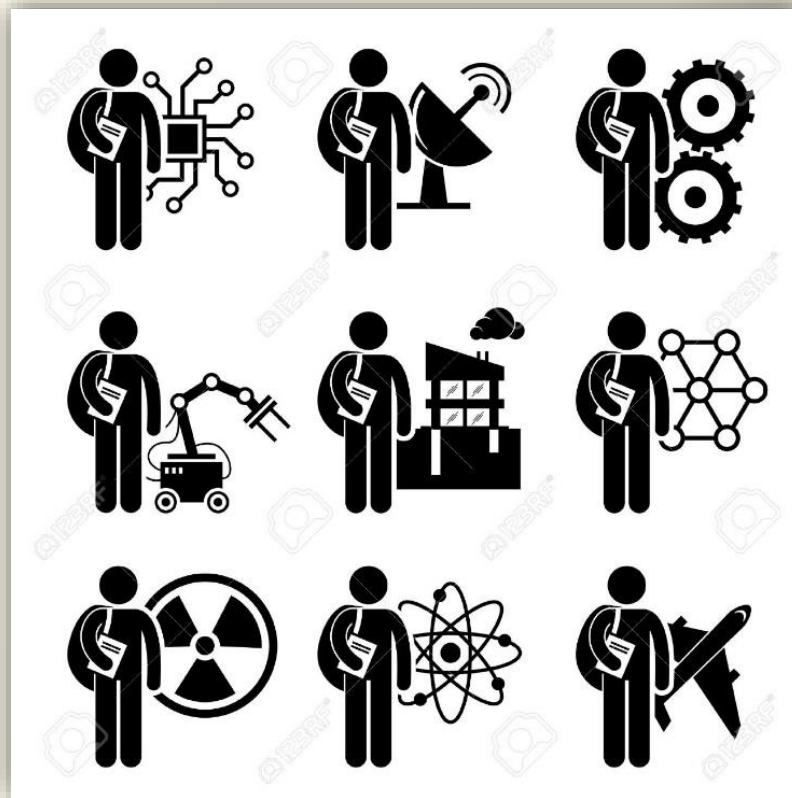
- Anti-corrosion coating
- Cordless vacuums
- Arterio vision
- Cochlear implants
- Insulin pump
- Charge coupled devices
- Water filters

Engineers

- Engineering combines mathematics, science, and technology to produce creative solutions to real world problems
- Professional, Engineering and Scientific (70% of NASA's positions)

➤ Major branches of engineering:

- Aerospace
- Mechanical
- Chemical
- Civil
- Electrical
- Biomedical
- Computer



***Hundreds of different subcategories of engineering under each branch**

EDUCATION

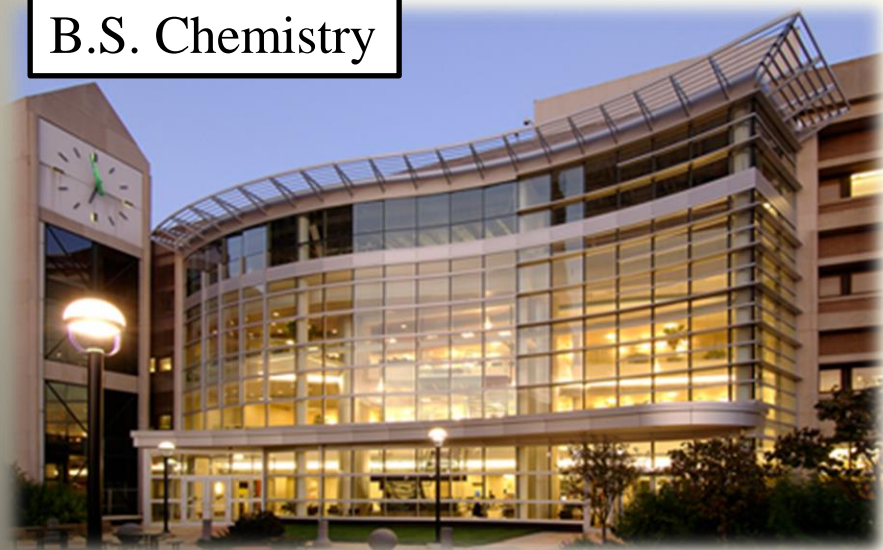
NASA Glenn Research Center



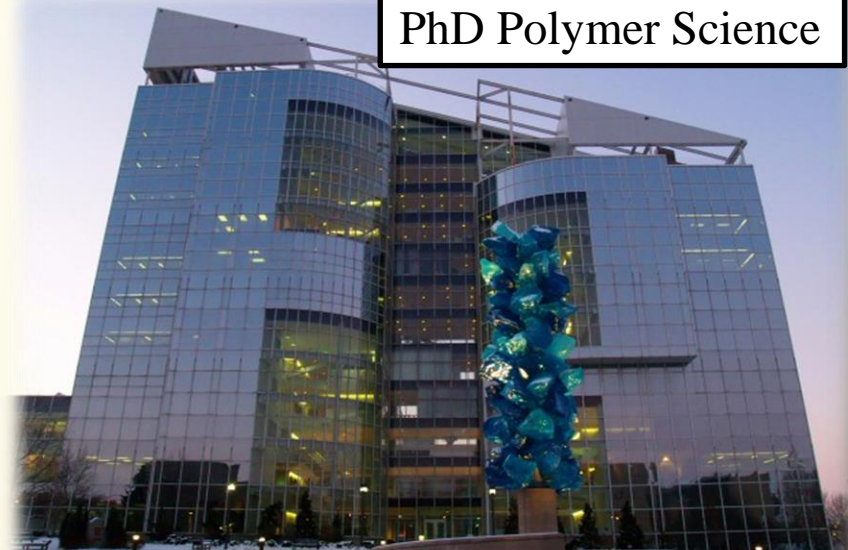
NASA Cooperative
Education Program

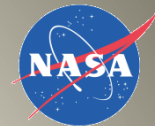


B.S. Chemistry



PhD Polymer Science





Office of STEM Engagement/Education

A Universe of NASA Opportunities



NASA
STEM GATEWAY

Your Gateway for Participating in NASA STEM Opportunities



INTERNSHIPS



COLLEGE STEM EXPERIENCES

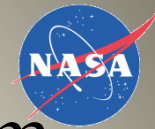
FELLOWSHIPS



CHALLENGES



EDUCATOR PROFESSIONAL DEVELOPMENT



Students and Recent Graduates: Pathways Program

Pathways Program

NASA Pathways Programs provide opportunities for students and recent graduates to be considered for federal employment through:

- NASA Pathways Intern Employment Program (IEP)
- NASA Pathways Recent Graduates Program (RGP)
- NASA Pathways Presidential Management Fellows (PMF)

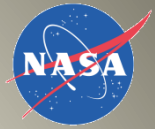
Program



PATHWAYS PROGRAM REQUIREMENTS

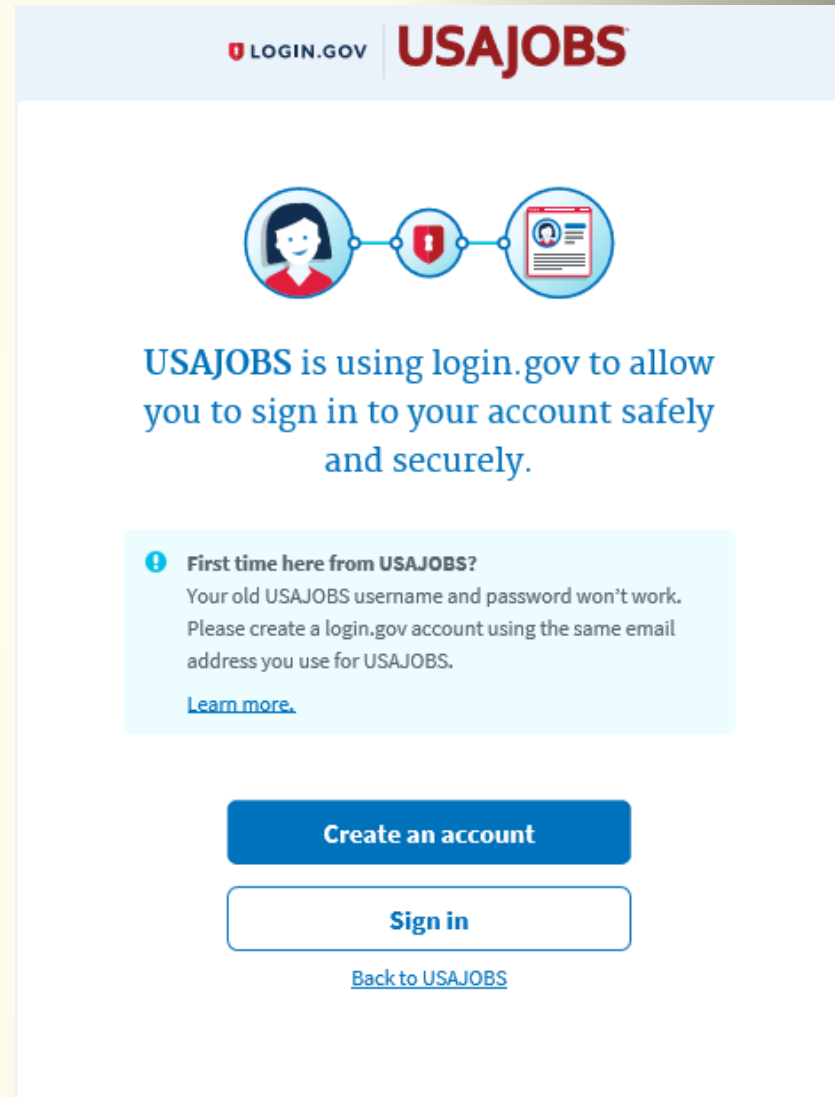
1. U.S. citizenship or U.S. national
2. Successfully completed at least 30 semester hours of undergraduate education
3. Currently enrolled in (or accepted for enrollment to) an accredited college or university on at least a half time basis
4. Currently have and maintain a cumulative GPA of 2.9 or higher (on a 4.0 scale)
5. Be able to complete at least 640 hours of Pathways work experience prior to completing your degree requirements
6. Have at least one academic year remaining in your degree program. *Center requirements may vary, please read each vacancy for specific Center details.

* Veterans Preference does apply to all Pathway opportunities.




Pathways Intern-WHERE TO APPLY

1. Go to usajobs.gov
2. Create a profile (fill in all the fields). Make sure you indicate veteran's preference status
3. Create a resume in usajobs.gov (don't upload a resume). You can save up to 5 different resumes
4. Make your resume searchable
5. Create a search agent so that you receive an email when opportunities match your criteria

A screenshot of the USAJOBS login page. At the top, there is a header with the "LOGIN.GOV" logo and the "USAJOBS" logo. Below the header, there is a graphic showing a person icon, a shield icon, and a document icon connected by lines. The main text reads: "USAJOBS is using login.gov to allow you to sign in to your account safely and securely." Below this, there is a light blue box with an information icon and the text: "First time here from USAJOBS? Your old USAJOBS username and password won't work. Please create a login.gov account using the same email address you use for USAJOBS. [Learn more.](#)" At the bottom, there are two buttons: a blue "Create an account" button and a white "Sign in" button with a blue border. Below the "Sign in" button is a link that says "Back to USAJOBS".

LOGIN.GOV | **USAJOBS**



USAJOBS is using login.gov to allow you to sign in to your account safely and securely.

First time here from USAJOBS?
Your old USAJOBS username and password won't work. Please create a login.gov account using the same email address you use for USAJOBS.
[Learn more.](#)

Create an account

Sign in

[Back to USAJOBS](#)

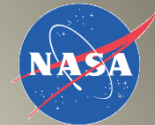
PATHWAYS RESUME TIPS -“TAKE CARE OF THE BASICS”

1. Include your contact information (City, State, Zip Code)
2. Use professional email address
3. Create a professional message on your voicemail
4. Check with your references before using their names
5. Check your spelling and grammar
6. Include all major education factors (GPA, graduation date, degree level, major, relevant coursework)



PATHWAYS RESUME TIPS -“STAND APART FROM THE CROWD”

1. Work Experience (you are not limited to 1 page)
 - Document all related jobs
 - Describe unrelated jobs the right way
 - Include project experience
2. Think Like an Employer (tailor your application to the position)
3. Federal resumes can be longer and require more information than private sector/non-profit resumes.
4. Don't leave a box blank!



Pathway Resume Tips

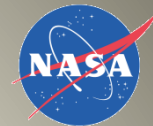
Describing your experience/qualifications

- Focus on the qualification requirements section of the vacancy announcement-your resume should describe how you meet the requirements
- Resume should be results driven -Use the S.A.R method: Describe the Situation, Action, and Result.
- Use action words to describe work experience: managed, assisted, responded, planned, coordinated, implemented, communicated with, tested, developed, spearheaded, etc.
- Include special skills like computer proficiency and language ability
- Plan ahead -Allow plenty of time to thoroughly proof-read and complete your application
- Apply by the deadline or better yet –early!

NASA Pathways Internship Program
Center-Specific Requirements
Spring 2022 Recruitment



Center/location	Available Start Date(s)	Graduation No Earlier Than	Minimum Work Requirement	Work Schedule
Ames Research Center – Moffett Field, CA	6/6/2022	9/23/2022	640 hours	Part-time Full-time
Armstrong Flight Research Center – Edwards Air Force Base, CA	6/6/2022	9/23/2022	640 hours	Full-time
Glenn Research Center – Cleveland, OH	6/6/2022	9/23/2022	640 hours	Part-time Full-time
Goddard Space Flight Center – Greenbelt, MD Fairmont, WV Wallops Island, VA	6/6/2022	5/1/2023	640 hours	Part-time Full-time
Kennedy Space Center – Florida	6/6/2022	9/23/2022	640 hours	Full-time
Langley Research Center – Hampton, VA	6/6/2022	9/23/2022	640 hours	Part-time Full-time



NASA's Office of STEM Engagement

NASA OSE, in collaboration with the Mission Directorates and Offices, issue notice of funding opportunities (NOFOs) that solicit evidence-based projects that:

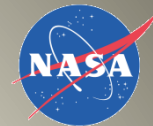
- Foster formal and/or informal STEM education
- Contribute to participation by underrepresented or underserved students and education organizations that predominantly (or historically) serve individuals traditionally underrepresented in STEM careers or underserved in STEM higher education, including but not limited to minorities, women, and persons with disabilities
- Engage self-directed learners



Programs

- NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES)
- NASA Post Doctoral Program (NPP)
- Established Program to Stimulate Competitive Research (EPSCoR)
- Minority University Research and Education Project (MUREP)
- Engagement Opportunities in NASA STEM (EONS)
- National Space Grant and Fellowship Project
- Next Gen STEM





Participate with NASA Solve

Opportunities to provide solutions to NASA and win cash awards, internships, and more



Run-way Functions: Predict Reconfigurations at US Airports
Award: \$40,000 in total prizes



Award: \$200,000 in total prizes

Opportunities to contribute ideas and help NASA with research and data



NASA is preparing for its next spaceflight simulation study and is seeking healthy participants to live together with a small crew in isolation for eight months in Moscow, Russia.



A close-up, low-angle shot of the James Webb Space Telescope's primary mirror, showing its large, gold-colored hexagonal segments. The telescope is set against a dark blue background, and the lighting highlights the metallic texture of the mirror segments.

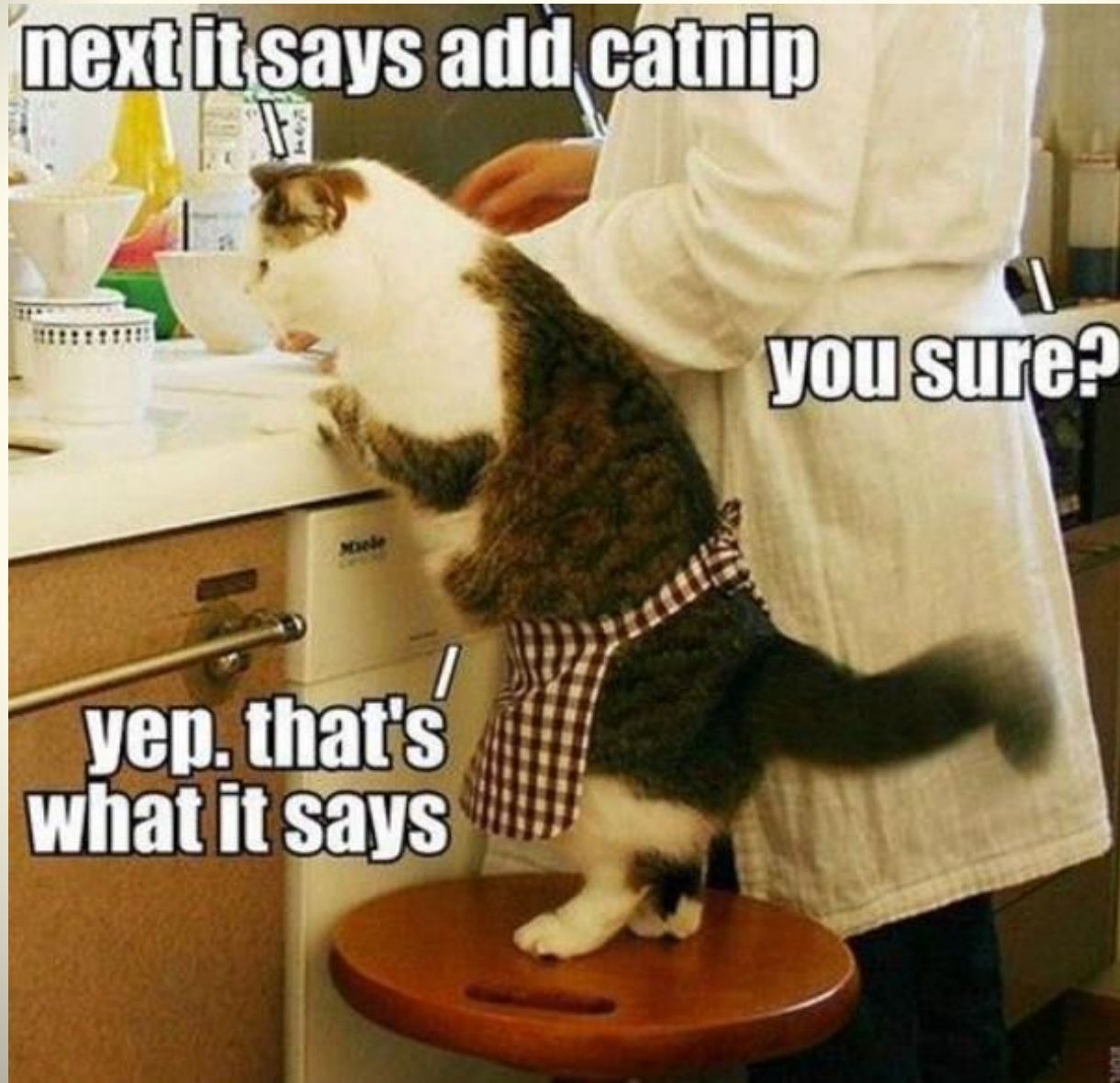
NASA 2022

THE FUTURE IS NOW

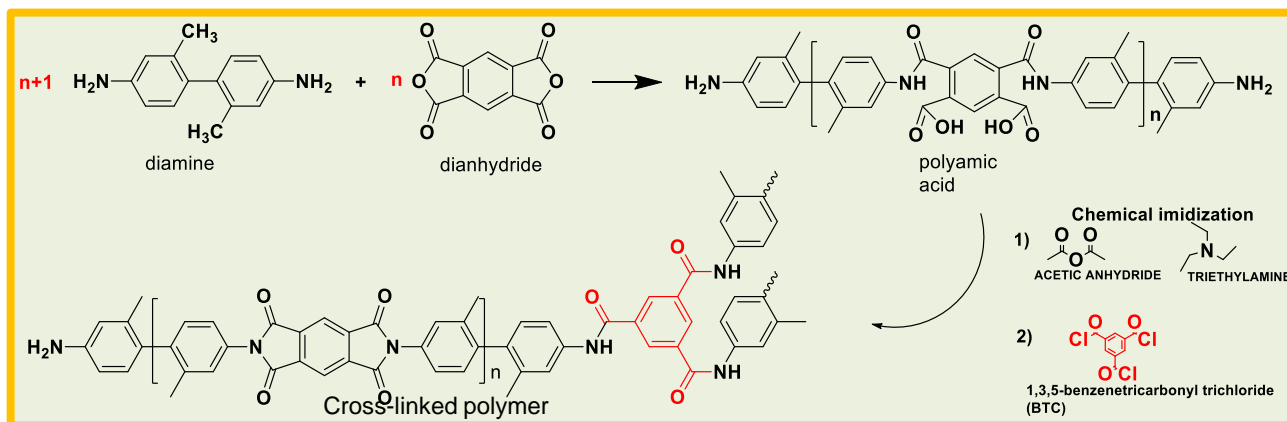
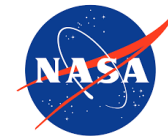
Receiving the first images from the James Webb Space Telescope, sending the first uncrewed Artemis mission around the Moon and back to Earth, sending NASA science and technology to the surface of the Moon on three missions with our commercial partners, and flying our first quiet, supersonic plane are just a few of the things NASA has planned for 2022.



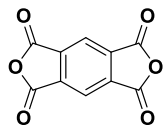
Everyone loves Chemistry!



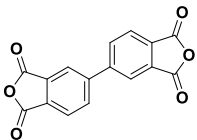
Polyimide Synthesis Mechanism and Monomers



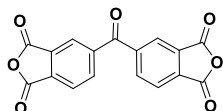
Dianhydrides



Pyromellitic dianhydride (PMDA)

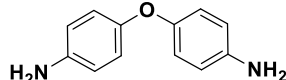


3,3',4,4'-biphenyltetracarboxylic dianhydride (BPDA)

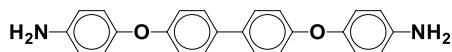


Benzophenone-3,3',4,4'-tetracarboxylic dianhydride (BTDA)

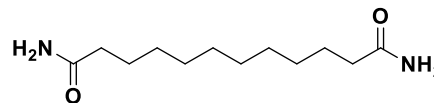
Diamines



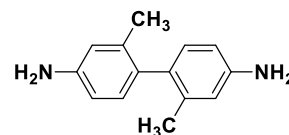
4,4'-oxydianiline (ODA)



4,4'-Bis(4-aminophenoxy) biphenyl (BAPB)

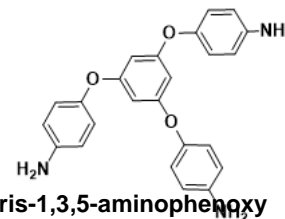


1,12-dodecylidiamine (DADD)

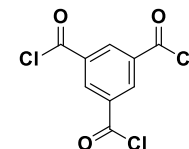


2,2''-dimethylbenzidine (DMBZ)

Cross-linkers

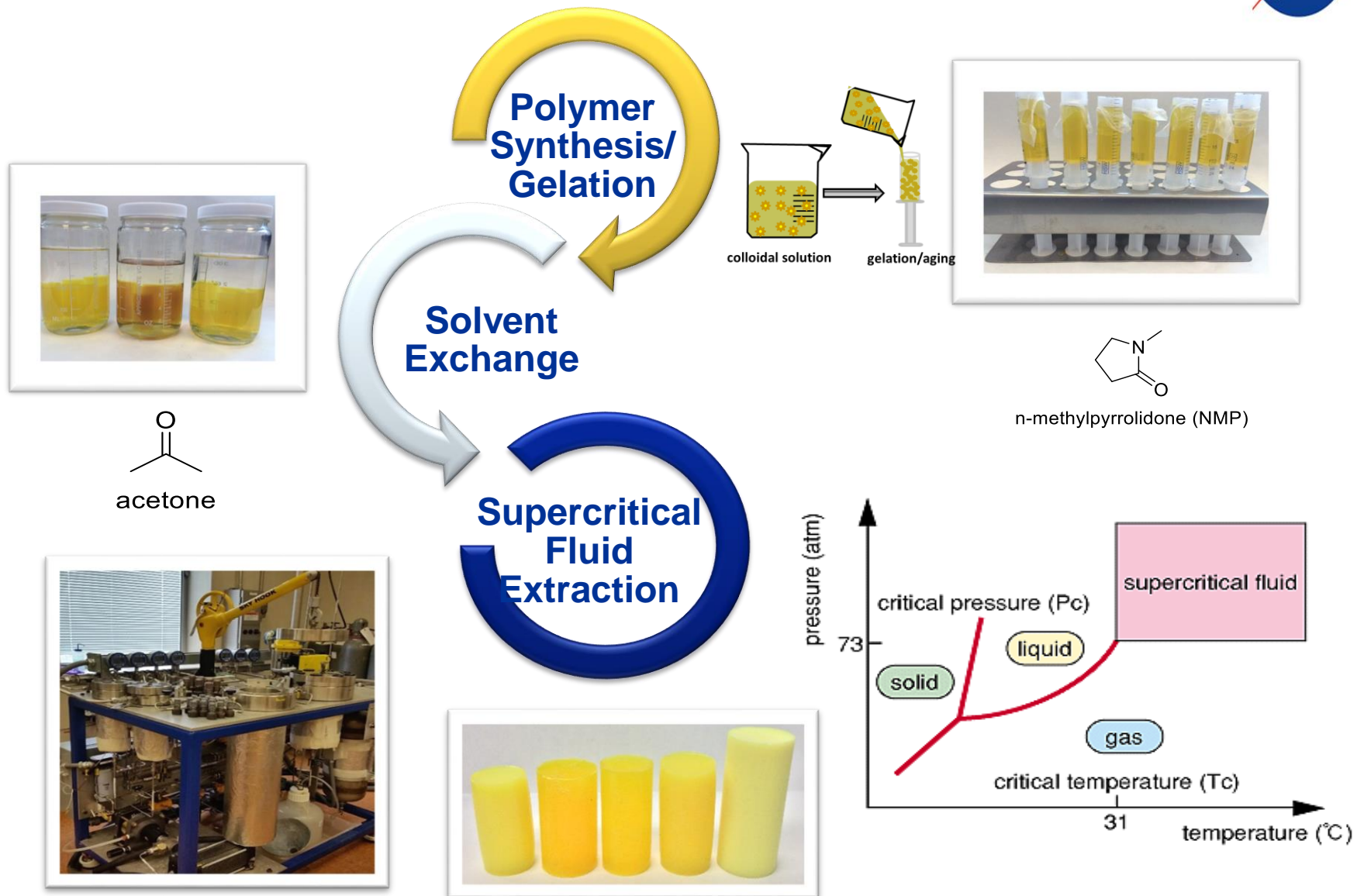


Tris-1,3,5-aminophenoxy benzene (TAB)



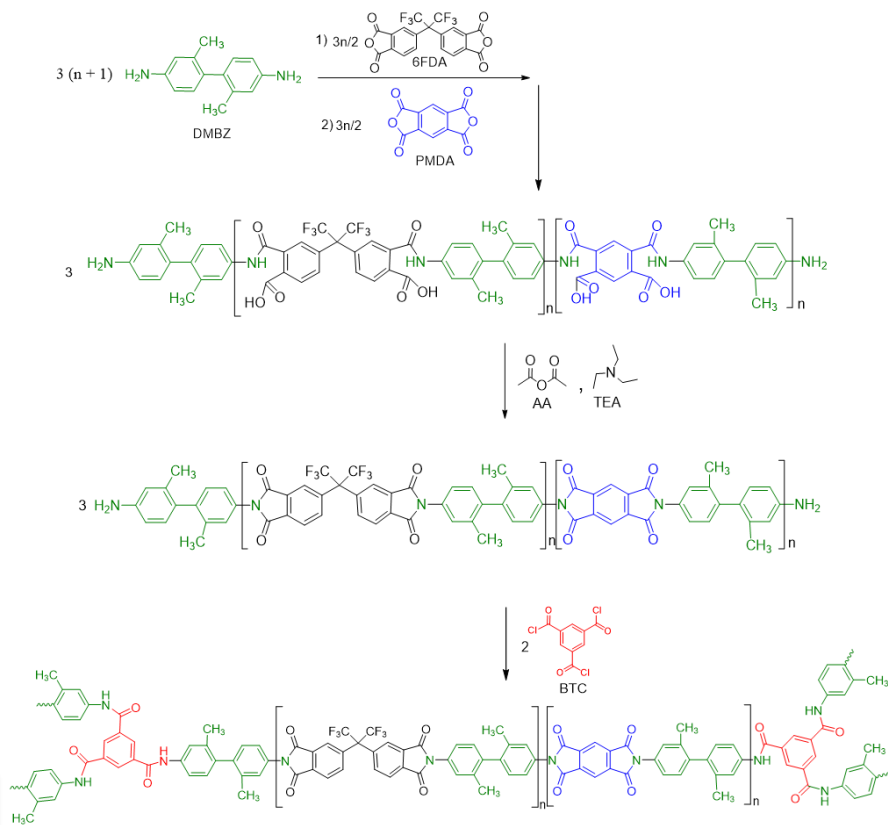
1,3,5-benzenetricarbonyl trichloride (BTC)

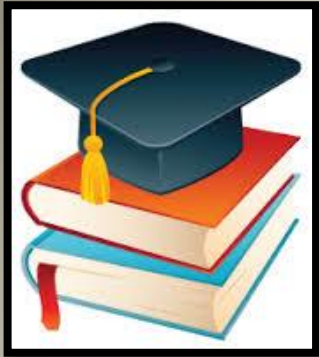
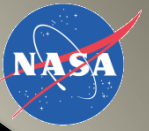
Aerogel Fabrication Process



Aerogels for Surviving the Lunar Night (ASLAN)

Higher transmissivity and optical clarity with fluorinated monomer



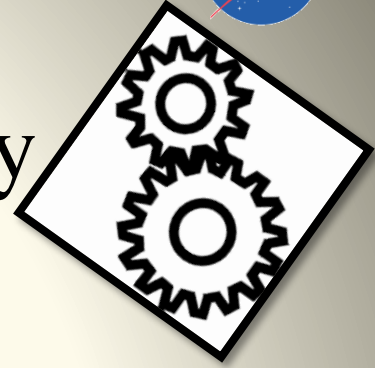


Government

Academia



Industry



* Funding:

industry: structured projects with budget requirements

academia: requires constant search for funding

government: policy based funding, varies and unreliable

*Time and Scale:

industry and government: larger scale due to resources

academia: less deadline specific

*Products:

academia: get money and publish

industry: produce something of value to the company

government: both